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Shattering Intermetallic Conventions

Researchers identify non-brittle intermetallic compounds

Scientists have known for more than 100 years that intermetallic materials — compounds consisting of two or more metals bonded together — possess chemical, physical, electrical, magnetic, and mechanical properties that are often superior to ordinary metals. The problem with these promising materials is that they're quite brittle at room temperature. Until now.

Ames Laboratory researchers have discovered a number of rare-earth intermetallic compounds that are ductile at room temperature. The discovery, announced in an article in the September issue of the journal *Nature Materials*, has the potential to make these promising materials more useful.

Brittle is the rule

"Many intermetallic materials are too brittle to handle," says senior metallurgist Karl Gschneidner, Jr. "If you drop them, they shatter. But you can beat on these new materials with a hammer, and they won't shatter or fracture ... they're that ductile."

So far, the Ames Lab research team led by Gschneidner and materials scientist Alan Russell has identified 12 fully ordered, completely stoichiometric intermetallic compounds. In other words, these materials

are combined in the proper chemical ratios, and the atoms are properly lined up.

"Intermetallics have been studied for decades," Russell says. "Tens of thousands of them have been identified, and there's a whole menu of 'tricks' that can be used, such as testing them at high temperatures, in zero-humidity, *continued on page 2*



The yttrium-silver button shows dents and deformation from repeated hammer blows. The gadolinium-silicon-germanium material was shattered with a light tap from the hammer.